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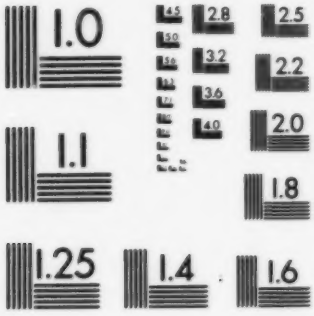

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TECHNICAL MEMORANDUM

MOBILE TAGA SURVEY
RIMPLY MANUFACTURING CO.
NEWMARKET, ONTARIO

ARB-055-86-AQM

February, 1986

Ontario
Ministry of the Environment

C. E. DUNCAN, Acting Director
Air Resources Branch

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Dr. David Balsillie, Director
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Prepared for:
The Central Region
Ministry of the Environment

Prepared by:
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Senior Project Scientist
Air Resources Branch

February 1986

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EXECUTIVE SUMMARY

During the week of May 6, 1985 the mobile TAGA unit of the Air Resources Branch conducted a mobile air monitoring survey in Newmarket, Ontario, as requested by the Central Region. The survey objective was to identify the malodourous contaminants originating from Rimply Manufacturing located at 402 Mulock Drive. Interpretation of the TAGA mass fingerprints acquired during brief odour episodes suggests the presence of several (up to 15) paint solvents. The contaminants tentatively identified were: propanol, ethylene glycol, methyl ethyl ketone, ethyl acetate, cellosolve, cyclohexylamine, methyl isobutyl ketone, xylene and/or ethyl benzene, methyl amyl ketone, butyl acetate and/or diacetone alcohol, butyl cellosolve, cellosolve acetate, and butyl cellosolve acetate. The ambient concentrations of all contaminants detected by TAGA were well below (orders of magnitude) existing Ministry standards or guidelines. In combination the contaminants are producing detectable odours that were recorded by the staff.

It should be noted that subsequent to this survey, as a result of a series of public complaints of odours in the area of the plant, the Ministry has issued violation notices to the Rimply Manufacturing Company.

INTRODUCTION

At the request of the Central Region, the Air Resources Branch conducted an air monitoring survey in Newmarket, Ontario. The objective of this study was to chemically characterize the odours originating from Rimply Manufacturing at 402 Mulock Drive. Rimply, a subsidiary of Magna International, primes and paints vehicle parts. Shortly after Rimply commenced their operation in the summer of 1984 the Ministry of the Environment began receiving odour complaints from local residents. Presented here are the findings of the subsequent air quality study conducted by the mobile TAGA unit in May, 1985.

THE MAMU NO.3 AND SURVEY STRATEGY

The MAMU No.3 is a unique mobile laboratory containing the TAGA (Trace Atmospheric Gas Analyzer) 3000. A computerized mass spectrometer, the TAGA is capable of direct air sampling and real-time monitoring of a broad range of contaminants. Essentially the technique is sensitive to any volatile organic chemical containing a nitrogen, sulfur, or an oxygen atom. Typical detection limits for the more common chemical classes; i.e. amines, ketones, esters, sulfides, are in the low ug/m^3 range.

One asset of the mobile TAGA unit is its ability to track odourous plumes to their source. The general survey strategy in Newmarket was to locate the Rimply plume using real-time measurements of target contaminants such as methyl ethyl ketone and/or cellosolve acetate. If odours persisted, mass scans, or fingerprints of the ambient air, were collected using a variety of chemical ionization reagents and operational (ion energy) parameters. Mass spectra were also collected upwind of Rimply so that the downwind data could be background corrected.

In addition to fingerprinting the plume and the collection of mass scans, selected contaminant monitoring was performed for cellosolve acetate, a common component of paint formulations. This monitoring technique provides real-time ambient concentration data over a period of at least 30 minutes for a single sampling point. The TAGA was calibrated for cellosolve acetate on a daily basis. The relative standard deviation for multiple injections of a known standard was less than 20%.

The MAMU No. 3 is also equipped with meteorological instrumentation to monitor the local wind direction, wind speed and ambient temperature

simultaneously with the collection of air quality data. The meteorological data are measured at a height of 10 meters, while the unit is stationary.

DISCUSSION

At the request of the Central Region the TAGA unit conducted the air quality survey during the week of May 6, 1985. This report summarizes only the findings of May 6 and 9, when the meteorological conditions were favourable, that is, southerly winds. This was the desired wind direction since the odour complaints originated from the main residential area located to the north of Rimply.

GENERAL OBSERVATIONS

From the time of our arrival an obvious odour existed in the area downwind of Rimply. The intensity of the odour varied from mild to moderate, and could rarely be termed strong. The odour could be characterized as a sweet aroma, similar to that of ketones, and one typically associated with paint solvents. In the residential region the odour occurred with irregular frequency and lasted for only brief periods. The sweet aroma was not detected upwind of Rimply.

Prior to the survey questions were raised regarding the odourous contributions of Acriform, a fiberglass manufacturer located on Mulock Drive just north of Rimply. A distinctive odour resembling styrene was detected on Cane Parkway downwind of Acriform. This odour was generally very faint and was rarely detected even at close proximity to the plant. The Acriform odour was never observed in the residential area, although it could have been masked by the sweet Rimply aroma. As well, during the evenings of May 6 and 9 the sweet Rimply odour persisted after Acriform had apparently ceased their daily operation.

TAGA RESULTS - FINGERPRINT

The data from several fingerprints obtained in the vicinity of Rimply on May 6 and 9 were consistent with the odour observations. An example of an actual mass scan acquired downwind during a faint odour incident is shown in Figure 1. The identification of the major (mass) peaks is based on spectral interpretation and as such should be considered tentative. A summary of all the fingerprint results may be found in Table 1. Note that these are estimated concentrations calculated from instantaneous measurements acquired over a scan time of 15 seconds. A description of the monitoring periods may be found in Table 2 and the sampling locations are indicated in Figure 2.

Analysis of the mass spectra data for May 6 and 9 provided a fingerprint which is characteristic of an auto painting operation. Several solvents were tentatively identified downwind of Rimply. The fingerprint data has been summarized as follows:

1) The most abundant contaminants monitored were: propanol, methyl ethyl ketone, cellosolve, cellosolve acetate and xylene/ethyl benzene;
2) Trace levels of styrene and acetone were detected downwind of Acriform (Sample 6);
3) The highest estimated concentration of the contaminants coincided with the incidents of strongest odour. These levels were recorded downwind of Rimply on Mulock (Samples 3, 5, 8);
4) The contaminants were observed in the residential area north of Rimply whenever odours were detected;
5) During periods when odours were faint the relative levels were lowest (Samples 1, 2, 9);
6) Samples 8 and 9 were acquired after Acriform had ceased production for the day. No contaminants were detected downwind of Acriform (Sample 9), although several contaminants were recorded downwind of Rimply (Sample 8).

The fingerprint results provide analytical evidence that Rimply was a source of odours, although the odours were generally mild. Some 15 organic compounds were tentatively identified in the ambient air samples collected downwind of Rimply. By comparison, Acriform was a minor source of organics (those detectable by the TAGA) and odours. Only 2 compounds, acetone and styrene (trace levels), were found to originate from Acriform. Note that none of the contaminants detected by TAGA approached the Ministry's existing standards or guidelines (see Appendix A).

PLUME TRACKING

Plume tracking refers to the acquisition of instantaneous concentrations of targetted pollutants while the MAMU No. 3 is mobile. The TAGA was programmed to measure the instantaneous concentration of ambient cellosolve acetate every 5 seconds while the TAGA unit was slowly driven throughout the neighbourhood. Figure 3 is an example of some plume tracking results obtained on May 9, from 15:11 to 15:51. During this time the winds were from the southwest gusting to approximately 30 km/hr. These results indicate that Rimply, not Acriform, was the source of the cellosolve acetate plume. In this

example the highest ground level (instantaneous) concentration was 125 ug/m^3, recorded northeast of Rimply near the intersection of Steven Court and Mulock Drive. Figure 3 also shows that the levels for cellosolve acetate decreased rapidly within a few hundred meters of the source.

SELECTED POLLUTANT MONITORING

Ambient levels of cellosolve acetate were also recorded for periods of 30 minutes while the TAGA unit was stationary. The selection of the sampling sites was based upon the plume tracking results, the occurrence of odours and the prevailing winds. In all, ten (10) half-hour averaged concentrations were determined for cellosolve acetate and these are summarized in Table 3. The concentrations of cellosolve acetate range from 1.8 ug/m^3 (Sample C5) to 170 ug/m^3 (Sample C1). In general, higher levels were observed at locations nearer Rimply, when odours were relatively strong (Figure 4). Indeed the highest levels were recorded on Mulock Drive directly downwind of Rimply (Samples C1 and C9). The maximum ½-hour concentration for cellosolve acetate in the residential area north of Mulock Drive was 40 ug/m^3 (Sample C4). It was generally observed that the instantaneous values for the cellosolve acetate concentrations varied greatly over the 30 minute monitoring periods, as shown in Figure 5. These variations, which were probably due to wind shifts, explain the transient nature of the odours.

It should be noted that, being a single quadrupole instrument, the TAGA 3000 is basically a mass detector and consequently the concentrations of cellosolve acetate reported here represent the upper limits, or "worst case". Chemical interferences at the same ionic mass as cellosolve acetate (m/z=133) may falsely inflate the cellosolve acetate measurements. It is also noteworthy that the TAGA measures gas phase contaminants. The Ministry guideline of 100 ug/m^3 is based on the Total Suspended Particulate (TSP) and therefore the TAGA measurements are not directly comparable to the Ministry guideline.

TABLE 1

MOBILE TAGA SURVEY: NEWMARKET (1985) RIMPLY SURVEY

MS FINGERPRINT RESULTS

M/Z	Contaminant (Tentative I.D.)	Estimated Concentration (ug/m^3) Sample No.								
		1	2	3	4	5	6	7	8	9
	n =	11	8	7	8	7	8	8	8	8
59	Acetone	nd	nd	nd	35	nd	20	nd	nd	nd
61	Propanol	2	10	50	10	50	nd	35	nd	nd
63	Ethylene Glycol/Fragment	3	4	10	20	70	nd	10	20	nd
73	Methyl Ethyl Ketone	5	5	30	40	70	nd	50	20	nd
89	Ethyl Acetate	nd	nd	5	1	10	nd	nd	nd	nd
91	Cellosolve	2	10	40	40	70	2	20	20	nd
100	Cyclohexylamine	0.3	0.5	3	2	10	nd	3	4	nd
101	Methyl Isobutyl Ketone	nd	nd	10	5	20	nd	3	1	nd
104	Styrene	-	nd	nd	-	nd	5	nd	nd	nd
106	Xylene/Ethyl Benzene	-	5	50	-	100	nd	nd	20	nd
115	Methyl Amyl Ketone	nd	nd	10	40	10	nd	30	30	nd
117	Butyl Acetate/Diacetone Alcohol	nd	1	10	10	10	nd	10	6	nd
119	Butyl Cellosolve	nd	1	10	10	40	nd	10	9	nd
133	Cellosolve Acetate	1	6	45	30	230	nd	25	80	nd
161	Butyl Cellosolve Acetate	nd	nd	30	8	70	nd	10	5	nd

Note:
1: estimated concentrations represent arithmetic mean of n instantaneous measurements
2: nd means 'not detected'
3: - means 'not scanned'
4: see Table 2 for sampling times, locations, source(s).
5: / means and/or

TABLE 2

MOBILE TAGA SURVEY: NEWMARKET (1985) RIMPLY SURVEY

SAMPLING TIMES AND LOCATIONS - FINGERPRINT SCANS

Sample No.	Date/Time	Location	Comments	Source
1	06-May-85 10:19-10:31	A (Cane)	Faint odour	Rimply
2	06-May-85 11:02-11:14	A (Cane)	Faint odour	Rimply
3	06-May-85 13:31-13:43	B (Mulock)	Moderate odour	Rimply
4	06-May-85 15:58-16:10	C (Cane)	Faint odour	Acriform & Rimply
5	09-May-85 11:43-11:55	F (Mulock)	Strong odour	Rimply
6	09-May-85 13:38-13:50	A (Cane)	Faint odour	Acriform
7	09-May-85 15:15-15:27	G (Kent)	Intermittent Odour	Rimply
8	09-May-85 18:15-18:27	I (Mulock)	Moderate odour	Rimply
9	09-May-85 20:15-20:27	J (Acriform)	No Odour	Acriform

Note: See Figure 1 for sampling locations.

TABLE 3

MOBILE TAGA SURVEY: NEWMARKET (1985) RIMPLY SURVEY

HALF-HOUR AVERAGES - AMBIENT CELLOSOLVE ACETATE CONCENTRATIONS

Sample	Date/Time	Location	Met. Conditions			Conc. (ug/m^3)		Comments
			WD	WS	AT	AV.	SHR	
C1	06-May-85 13:49-14:19	B (Mulock)	S	5/15	11	170	450	Constant, moderate odours
C2	06-May-85 14:43-15:13	A (Cane)	SE	3/12	12	23	150	Odours, variable winds
C3	06-May-85 17:18-17:48	D (Andrew)	S	0/12	10	3.4	22	Wind shifted, no odours during last 25 min.
C4	06-May-85 18:01-18:31	E (Roywood)	SSE	0/15	9	40	150	Noticeable odours
C5	06-May-85 18:48-19:18	A (Cane)	S/N	0/20	9	1.8	65	Severe wind shift after first 5 min., no odours
C6	09-May-85 11:58-12:28	F (Mulock)	SSW	10/20	17	49	280	Strong, intermittent odour
C7	09-May-85 12:29-12:59	F (Mulock)	SSW	10/25	18	64	370	Strong, intermittent odour
C8	09-May-85 14:35-15:05	G (Kent)	SW	20/40	22	77	260	Moderate odours, strong winds
C9	09-May-85 17:03-17:33	H (Steven)	WSW	15/25	24	140	310	Strong odours
C10	09-May-85 17:40-18:10	I (Steven)	WSW	20/40	25	67	280	Moderate odours, strong winds

Note 1: WD = Wind Direction
WS = Wind Speed (km/hr)
AT = Ambient Temperature (^{o}C)
SHR = Single Highest Reading (instantaneous concentrations)

Note 2: Cellosolve acetate concentrations are upper limits or maximum values (see text for explanation).

APPENDIX A

MINISTRY OF THE ENVIRONMENT STANDARDS AND GUIDELINES FOR COMPOUNDS DETECTED IN NEWMARKET (MAY 1985)

Compound	½-Hour Concentration (ug/m^3) (point of impingement)	Limiting Effect
Acetone	48,000 (S)	Odour
Propanol	24,000 (G)	Health
Ethylene glycol	N (-)	-
Methyl Ethyl Ketone	31,000 (S)	Odour
Ethyl Acetate	19,000 (S)	Odour
Cellosolve	N (-)	-
Cyclohexylamine	N (-)	-
Methyl Isobutyl Ketone	1,200 (G)	Odour
Styrene	400 (S)	Odour
Xylene	2,300 (S)	Odour
Ethyl Benzene	4,000 (S)	Odour
Methyl Amyl Ketone	N (-)	-
Butyl Acetate	15,000 (PG)	Irritant
Diacetone Alcohol	N (-)	-
Butyl Cellosolve	N (-)	-
Cellosolve Acetate	100 (G)	TSP
Butyl Cellosolve Acetate	N (-)	-

S - Standard

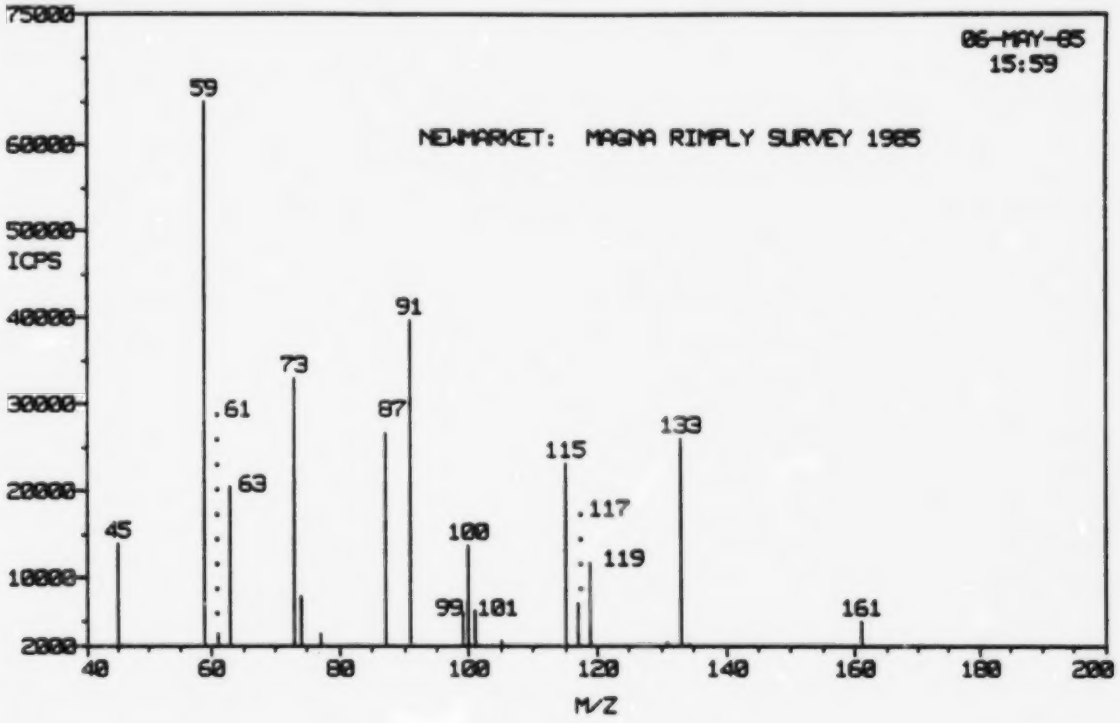
G - Guideline

PG - Provisional Guideline

N - Non-existent

TSP - Total Suspended Particulate

Figure 1: Mass Scan fingerprint recorded at 15:59, May 6, 1985;
location A on Cane Parkway, Newmarket.
Sampling location was downwind of Rimply and Acriform.
Note the data represents real signals (ion counts per second).
(TAGA 3000 direct air sampling, H2O CI, LCB).



M/Z	TENTATIVE IDENTIFICATION
45	FRAGMENT
59	ACETONE (ACRIFORM)
61	PROPANOL
63	ETHYLENE GLYCOL/FRAGMENT
73	METHYL ETHYL KETONE
87	FRAGMENT
91	CELLOSOLVE
99	FRAGMENT
100	CYCLOHEXYLAMINE
101	METHYL ISOBUTYL KETONE
115	METHYL AMYL KETONE
117	BUTYL ACETATE/DIACETONE ALCOHOL
119	BUTYL CELLOSOLVE
133	CELLOSOLVE ACETATE
161	BUTYL CELLOSOLVE ACETATE

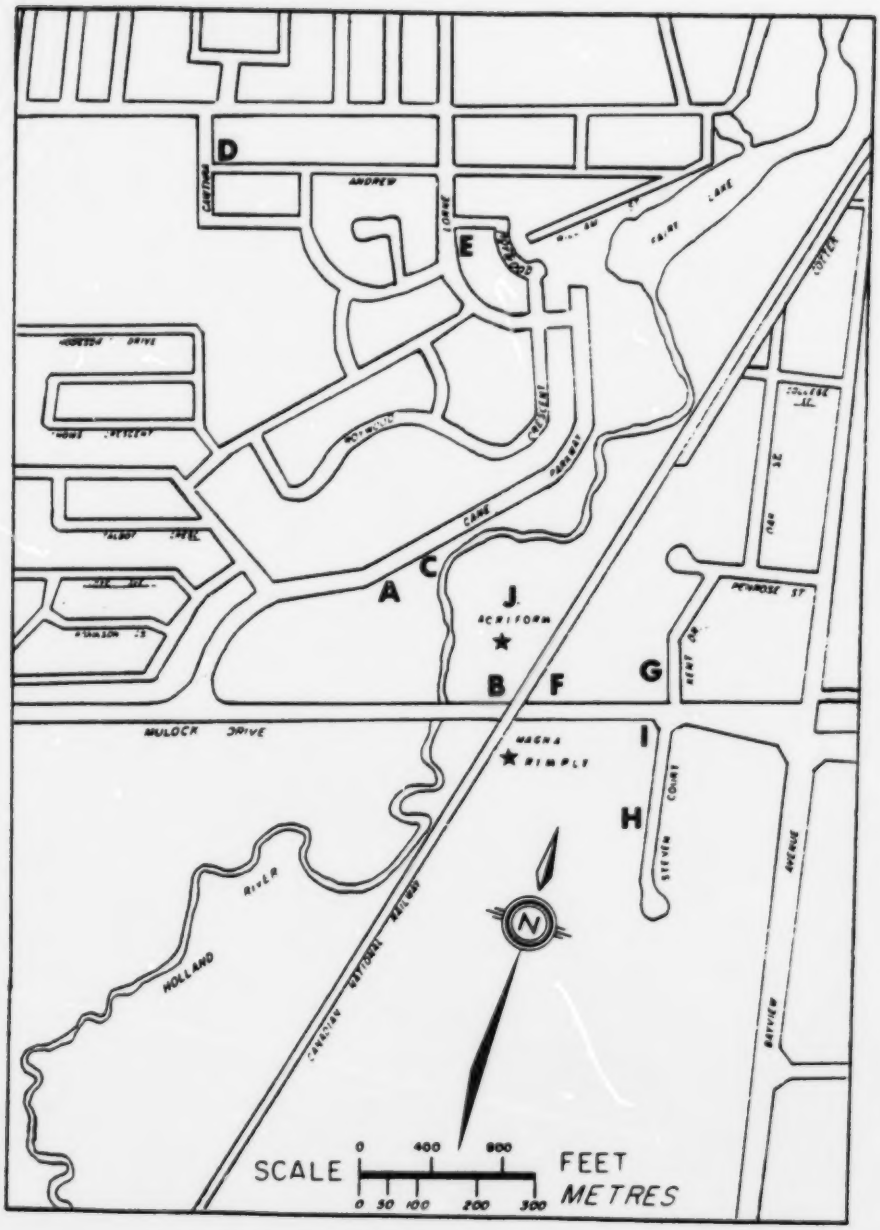


Figure 2: Newmarket: Magna Rimply Survey (1985)
MAMU No. 3 (TAGA)
Sampling Locations May 6 and 9, 1985.

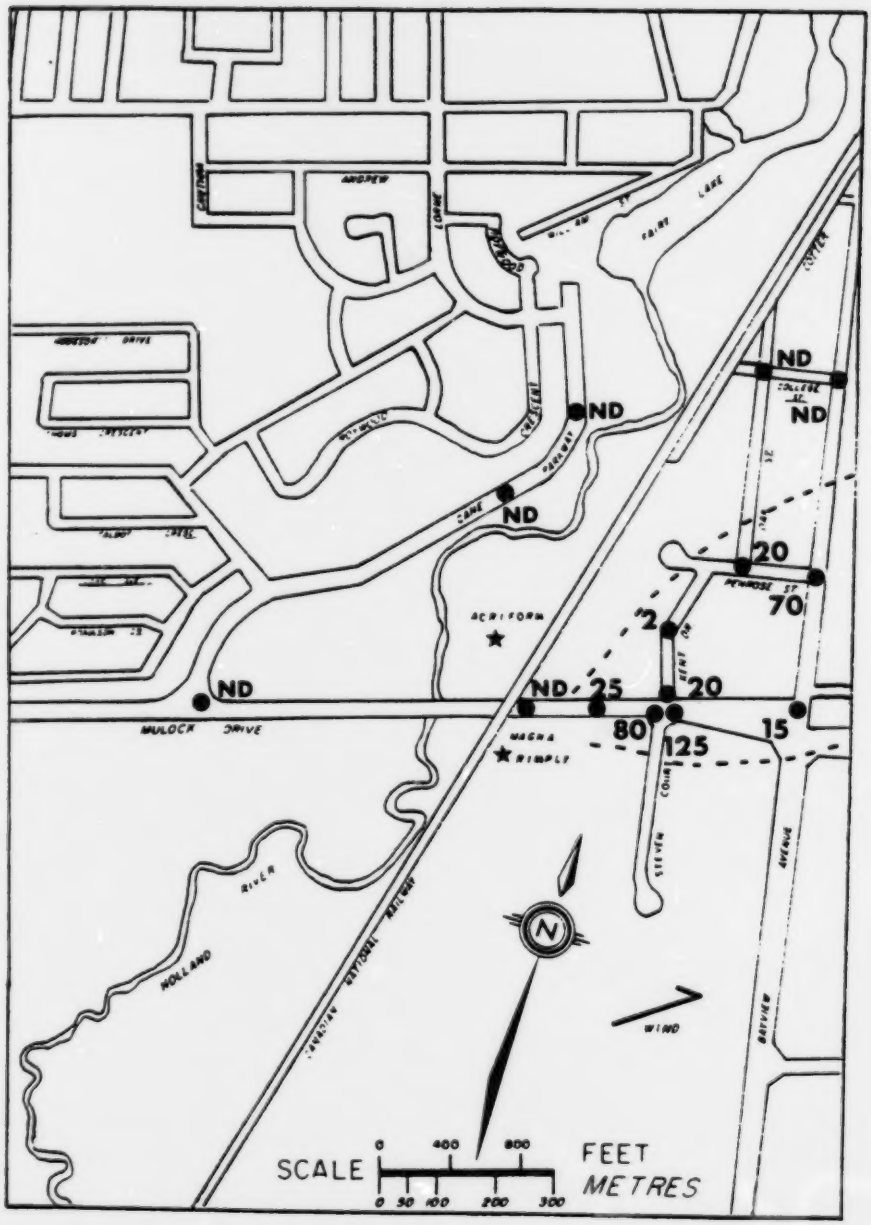


Figure 3: Neumarket: Magna Rimply Survey (1985)
MAMU No. 3 (TAGA)
Plume Tracking Results
Instantaneous Concentrations of
Cellosolve Acetate (ug/m3).
Sampling Period: 15:11 to 15:51 hrs.,
May 9, 1985.
Winds gusting to 30 km/h, out of SW.

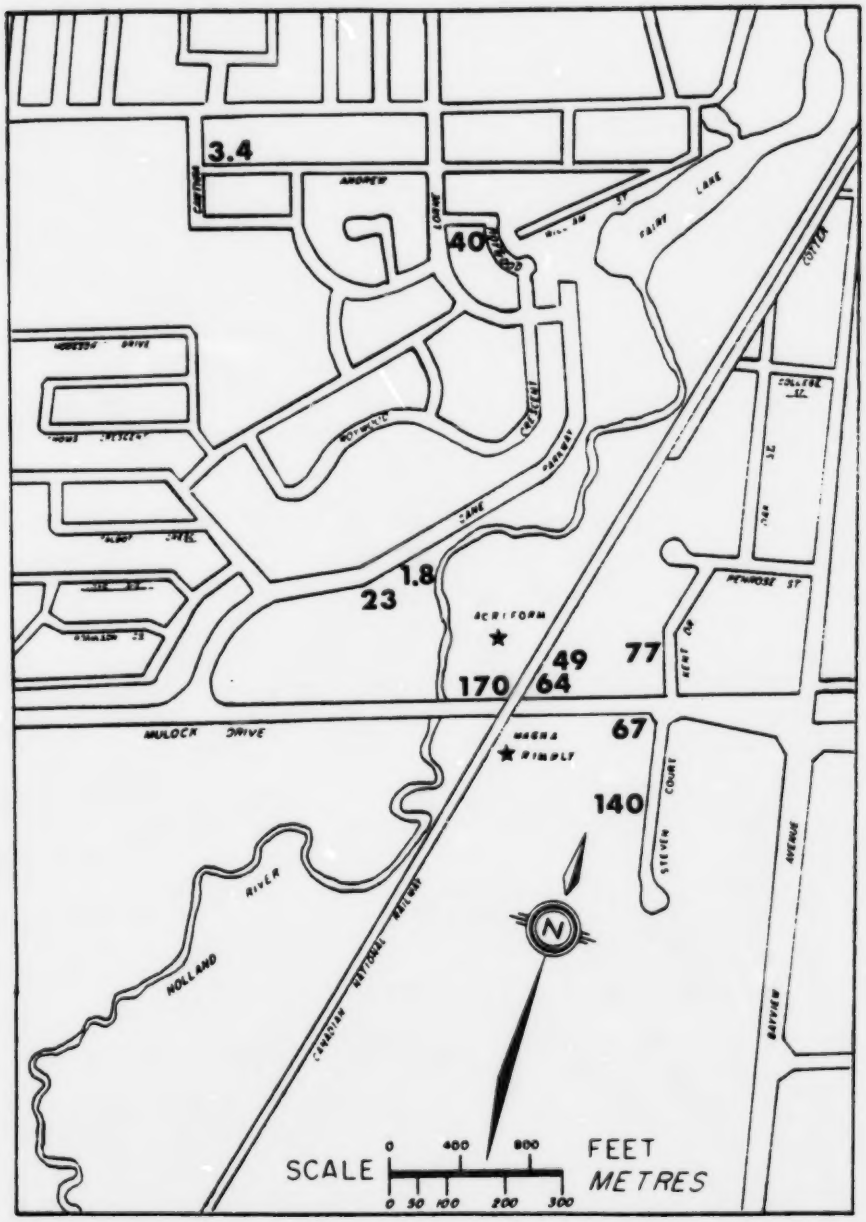


Figure 4: Newmarket: Magna Rimply Survey (1985)
MAMU No. 3 (TAGA)
30 Minute Averaged Concentrations of
Cellosolve Acetate (upper limits).
Obtained on May 6 and 9 1985.
(See Table 2 for more information.)

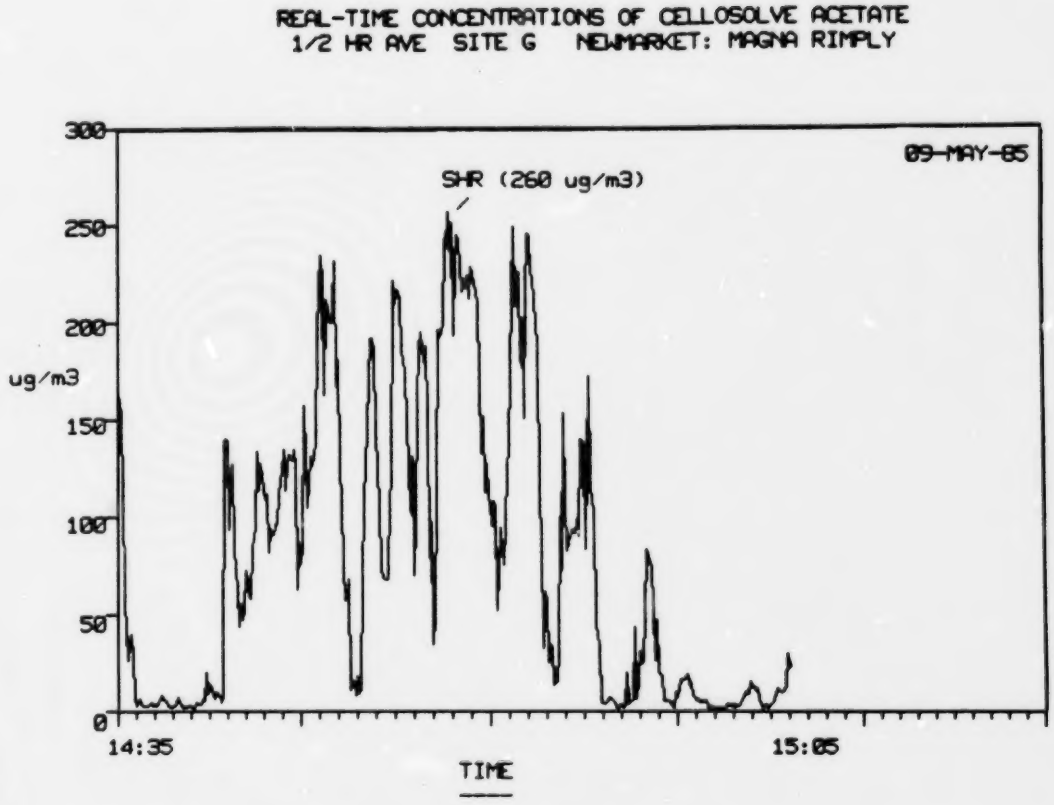


Figure 5: Real-time measurements of cellosolve acetate (Sample C8).
Recorded every 5 seconds over a 30 minute period.
Sampling location: Mulock Dr. directly downwind of Rimply.
Note the large variations in the instantaneous concentrations.
The single highest reading (SHR) was 260 ug/m3.
The 30 minute averaged concentration was 77 ug/m3.